WANDERING WARMOUTH OR SHANGHAIED SUNNIES

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BACKGROUND

Though the aptly named Warmouth *Lepomis gulosus* may be lacking in bright, vibrant colors—except for an eye-catching lavender margin on the gill cover—it is still undeniably a very handsome fish (Figure 1). The distinctive gaping mouth with war-striped cheeks does give the fish the appearance of always being ready for battle. I have found even young of the year warmouths live up to their name. There are few other Minnesota species with such an incredibly voracious appetite. I once put some little guys in with minnows and darters of the same size. Overnight, all their tankmates had disappeared and the contented Warmouth were all resting very fat and sassy, celebrating their conquest.

In Minnesota, Warmouth is a special concern species that has a natural distribution confined to the extreme southeastern Minnesota reach of the Mississippi River and backwaters from Wabasha to the Iowa border. However, the species has not been reported from its most northerly occurrence in Clear Lake (Wabasha County) since 1956. In stark contrast Warmouth occur throughout Wisconsin (Figure 2), including shared drainages with Minnesota (i.e., Lake Superior and St. Croix River). In the latter drainage, it almost reaches the Minnesota border near St. Croix Falls, WI. I asked John Lyons about the Warmouth distribution. He is a retired Wisconsin Department of Natural Resources (DNR) fisheries biologist and currently curator of fishes at the University of Wisconsin Zoological Museum. He concedes there likely have been introductions either by anglers or WI DNR staff who did not keep records. However, he believes the Warmouth's very widespread and even distribution indicates, for the most part, indigenous populations. George Becker (1983) suspected the occurrence of Warmouth in the headwaters of the Fox and Wolf rivers (Lake Michigan drainage) was the result of "wandering" over the drainage divide through the Fox-Wisconsin Canal at Portage, WI. Becker reported a total of seven species that may have used this drainage crossover (i.e., Shortnose Gar *Lepisosteus platostomus,* Bullhead Minnow *Pimephales vigilax,* Pugnose Minnow *Opsopoeodus emiliae,* Blackstripe Topminnow *Fundulus notatus,* Warmouth, Western Sand Darter *Ammocrypta clara,* and River Darter *Percina shumardi*). Later, Lyons added potentially 15 more species, but believes during periods of high water there were sporadic natural connections over the last several thousand years (Schmidt 2016). However, Becker also could not rule out the possibility this and other suspected Warmouth range extensions could be the result of fish rescue transfers (i.e., shanghaied) from the Mississippi River.

Figure 1. Warmouth from Indian Channel (Mississippi River, Winona County, MN). (Photo by Konrad Schmidt)

Around 2001, I was searching for distribution databases to write the species accounts and generate range maps for the *Fishes of Minnesota*. One source was a colossal database compiled from the Minnesota DNR lake surveys. My curiosity drove my initial queries filtered for rare species but returned very few records. I was familiar with known distributions in Minnesota drainages and a few extreme outliers "popped up" from the queries. Warmouth were caught in this dragnet with records from two lakes near Marcell, MN (Itasca County) in the Chippewa National Forest: Big Ole Lake in 1974 and 1982 and from nearby East Lake in 1982 (Figure 3). Both lakes are in the Hudson Bay drainage and about 240 air miles north of the species' nearest locality in Clear Lake (Figure 2). Big Ole is landlocked, but East is part of a chain of lakes in the Rice River watershed. My first thought was these were obviously either identification or data entry errors. Nevertheless, I had to check them out.

I contacted Jeff Tilma who is a biologist in the DNR Grand Rapids Area Fisheries Office. He was very aware of the Warmouth occurrences and believed they were valid. He also provided old correspondence in the office files that left a plausible trail to the Warmouth's source (Figure 4). In 1960, an angler from Marcell brought an odd sunfish caught in Big Ole Lake into the Grand Rapids office, where it was identified as a Warmouth. The angler also added he recalled that a Fisheries truck from St. Paul carrying small sunfish stocked a "can or two" in the lake. He thought this happened in the 1930s.

Like Wisconsin, fish transfers (aka fish rescues) were once a common practice performed without records documenting where the fish came from or where they went. One issue still remained.

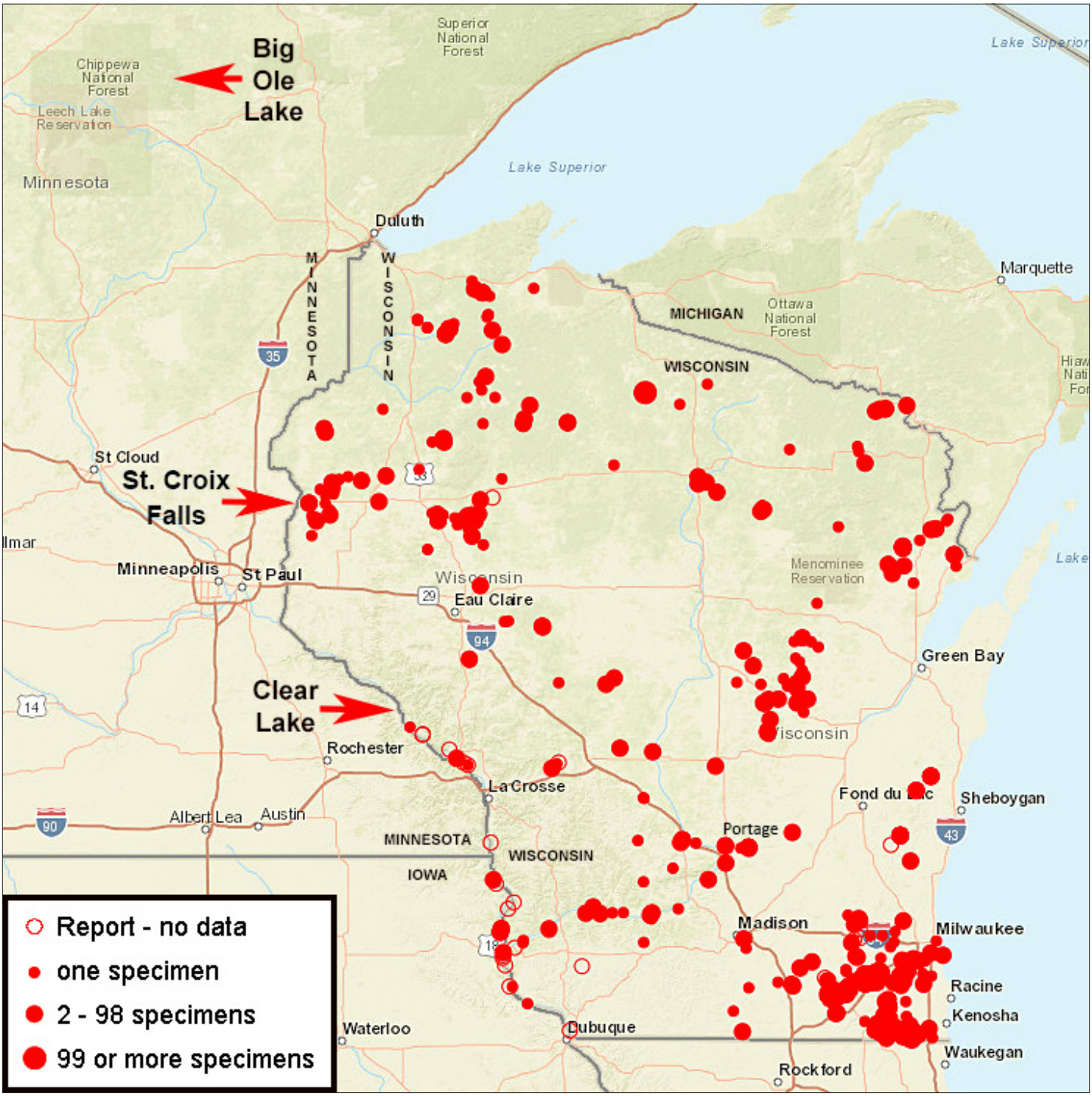


Figure 2. Warmouth distribution in Wisconsin (WDNR 2017). Note: many records have not been confirmed and could be erroneous. The general pattern is accurate, but some of the individual records are suspect (i.e., misidentifications or typos in the database) (John Lyons pers. comm.).

The keystone proof needed to confirm Warmouth existed in Big Ole was missing. I asked Jeff if they had any specimens or photographs of these fish. The answer was no, but coincidentally a survey of Big Ole was scheduled the same year and he would preserve a few fish. Any lingering doubt I had vanished when the Warmouth specimens arrived at the Bell Museum where they are now cataloged (JFBM 38114).

It can never be ruled out that some anglers will or have illegally transplanted Warmouth from Big Ole. Currently, the species is effectively quarantined there and cannot spread via migration because the lake fills a closed basin. However, climate change has recently set new precipitation records almost every year and just a rise of a few feet will cause Big Ole to spill out through a pour point at the far west end of the lake into the Rice River watershed (Figure 3). East Lake, on the other hand, has current stream connections to 17 lakes within a radius of about three miles also in the same watershed (Figure 5). The 1982 survey of East Lake recorded only one Warmouth. The

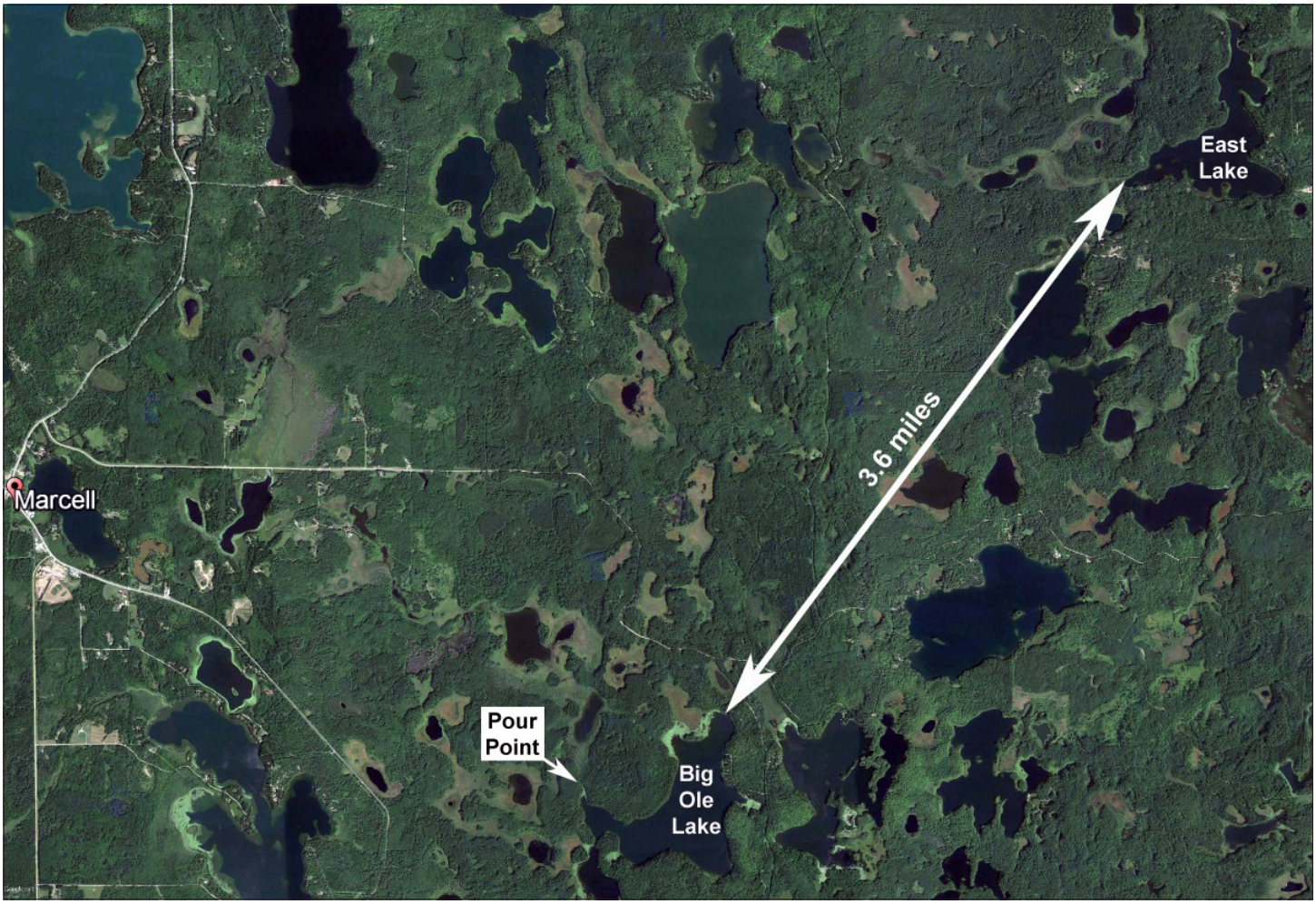
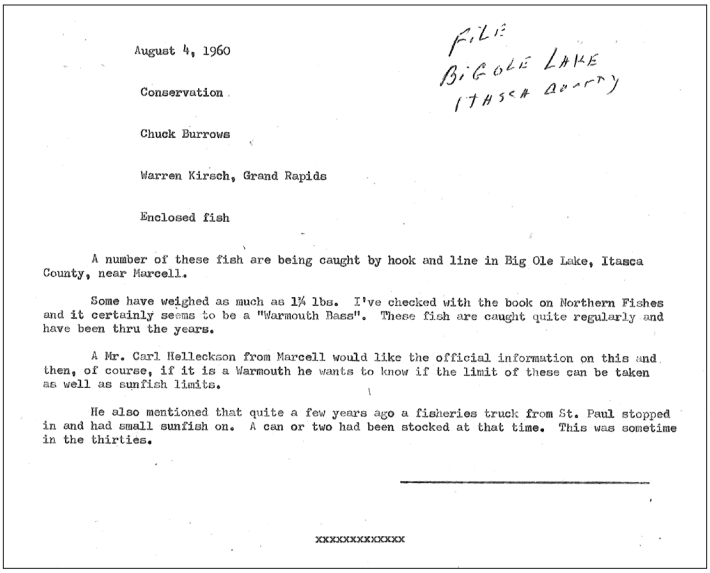


Figure 3. Warmouth occurrences reported in the Rice River Watershed: Big Ole and East lakes in Itasca County, MN.



August 4, 1960

File
Big Ole Lake
Itasca County

Conservation

Chuck Burrows

Warren Kirsch, Grand Rapids

Enclosed fish

A number of these fish are being caught by hook and line in Big Ole Lake, Itasca County, near Marcell.

Some have weighed as much as 1¼ lbs. I've checked with the book on Northern Fishes and it certainly seems to be a "Warmouth Bass". These fish are caught quite regularly and have been thru the years.

A Mr. Carl Helleckson from Marcell would like the official information on this and then, of course, if it is a Warmouth he wants to know if the limit of these can be taken as well as sunfish limits.

He also mentioned that quite a few years ago a fisheries truck from St. Paul stopped in and had small sunfish on. A can or two had been stocked at that time. This was sometime in the thirties.

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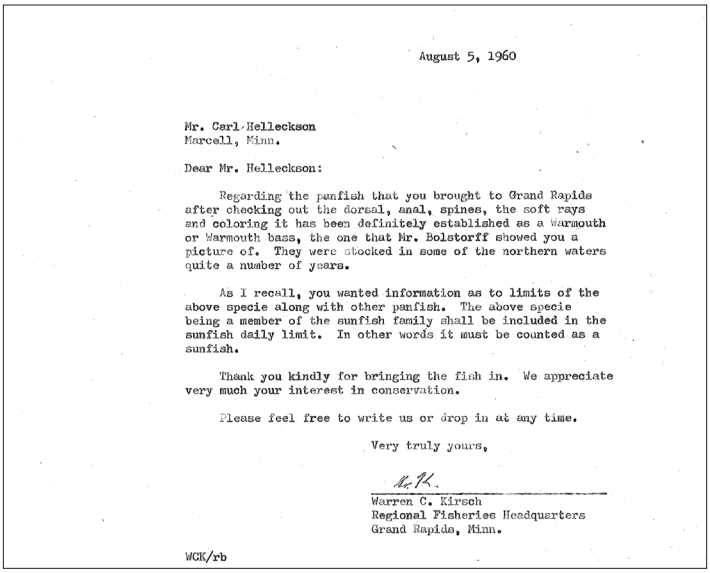

August 5, 1960

Mr. Carl Helleckson
Marcell, Minn.

Dear Mr. Helleckson:

Regarding the panfish that you brought to Grand Rapids after checking out the dorsal, anal, spines, the soft rays and coloring it has been definitely established as a Warmouth or Warmouth bass, the one that Mr. Bolstorff showed you a picture of. They were stocked in some of the northern waters quite a number of years.

As I recall, you wanted information as to limits of the above specie along with other panfish. The above specie being a member of the sunfish family shall be included in the sunfish daily limit. In other words it must be counted as a sunfish.

Thank you kindly for bringing the fish in. We appreciate very much your interest in conservation.

Please feel free to write us or drop in at any time.

Very truly yours,

Warren C. Kirsch
Regional Fisheries Headquarters
Grand Rapids, Minn.

WCK/rb

Figure 4. 1960 Warmouth correspondence.

lake has no public access, which is likely the reason follow-up surveys have not been done since. Of the 17 lakes, multiple DNR surveys have been done in Clubhouse (Figure 4: #6), Eagle (#17), and Gunn (#9) lakes and no Warmouth have been reported. In 2008, I did a DNR survey for rare fishes in Cameron (#2) and also did not encounter Warmouth. However, two state-listed species were found in the lake for the first time: Pugnose Shiner *Notropis anogenus* and Northern Sunfish *L. peltastes. I also found the first Northern Sunfish in Gunn the same year.* Hopefully, the 1982 record in East Lake will prove

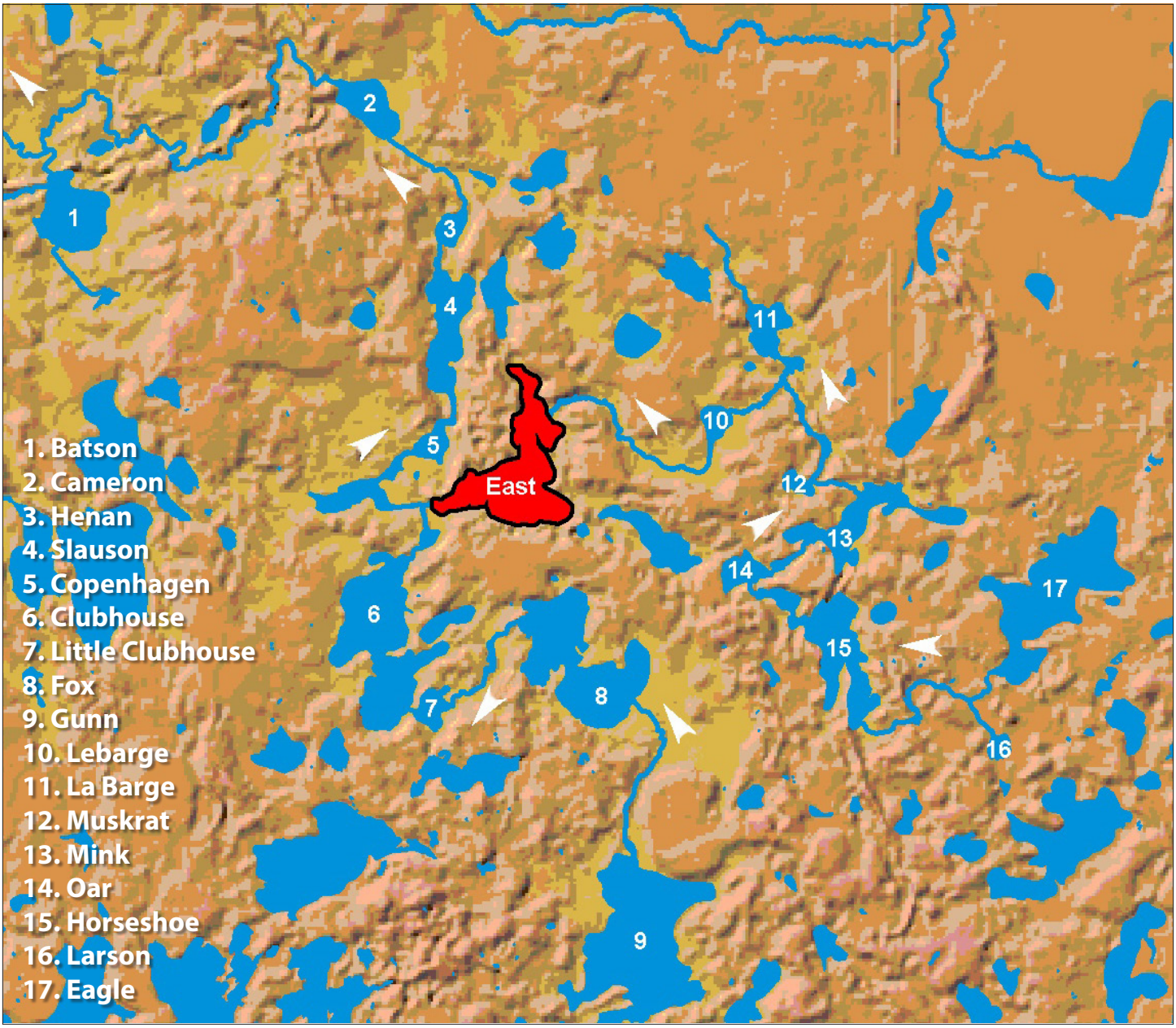

Figure 5. Rice River watershed lakes potentially accessible via fish migration from East Lake. Arrows indicate direction of flow.

to be the last in this chain of lakes. The Warmouth's aggressive and gluttonous nature would not bode well for Pugnose Shiner and also likely out-compete the mild-mannered Northern Sunfish.

How often and widespread have Warmouth been introduced outside their native ranges? The US Geological Survey (USGS) Nonindigenous Aquatic Species Database reports that Warmouth have been introduced to 27 states, and with few exceptions, are now considered established populations (Figure 6). I am hesitant to accept non-indigenous occurrences within ranges where species are considered to be native. Undeniably, Johnny Appleseed anglers and sanctioned stocking have established populations above barriers, new drainages, and landlocked lakes and ponds. Sometimes there is a paper trail to follow. However, the USGS (2017) data available on the web does not provide confidence levels where non-indigenous dots are within or border natural distributions. That would be, for me, much farther out on a limb than I'd ever dare go!

I did ask three experts about the non-indigenous occurrences on the map in Iowa, Missouri, and Oklahoma. John Olson recently retired from the Iowa DNR but remains active helping out with statewide stream surveys and maintaining the fish collection at Iowa State University. He feels that indigenous populations of Warmouth occur in Iowa's segment of the Mississippi River and in the lower portions of the interior rivers (e.g., lower Iowa, Cedar, and Wapsipinicon rivers) in extreme eastern and southeastern parts of the state. Historically, Warmouth may have occurred farther upstream in these Mississippi River tributaries before most backwaters and oxbows were destroyed due to agricultural and urban development. He believes the distribution map dots in south central and southwestern Iowa represent reservoirs stocked with Warmouth taken from Mississippi River backwaters during fish rescue operation of the 1930s and 1940s. This view is supported by others in Iowa such as retired Iowa DNR Chief of Fish-

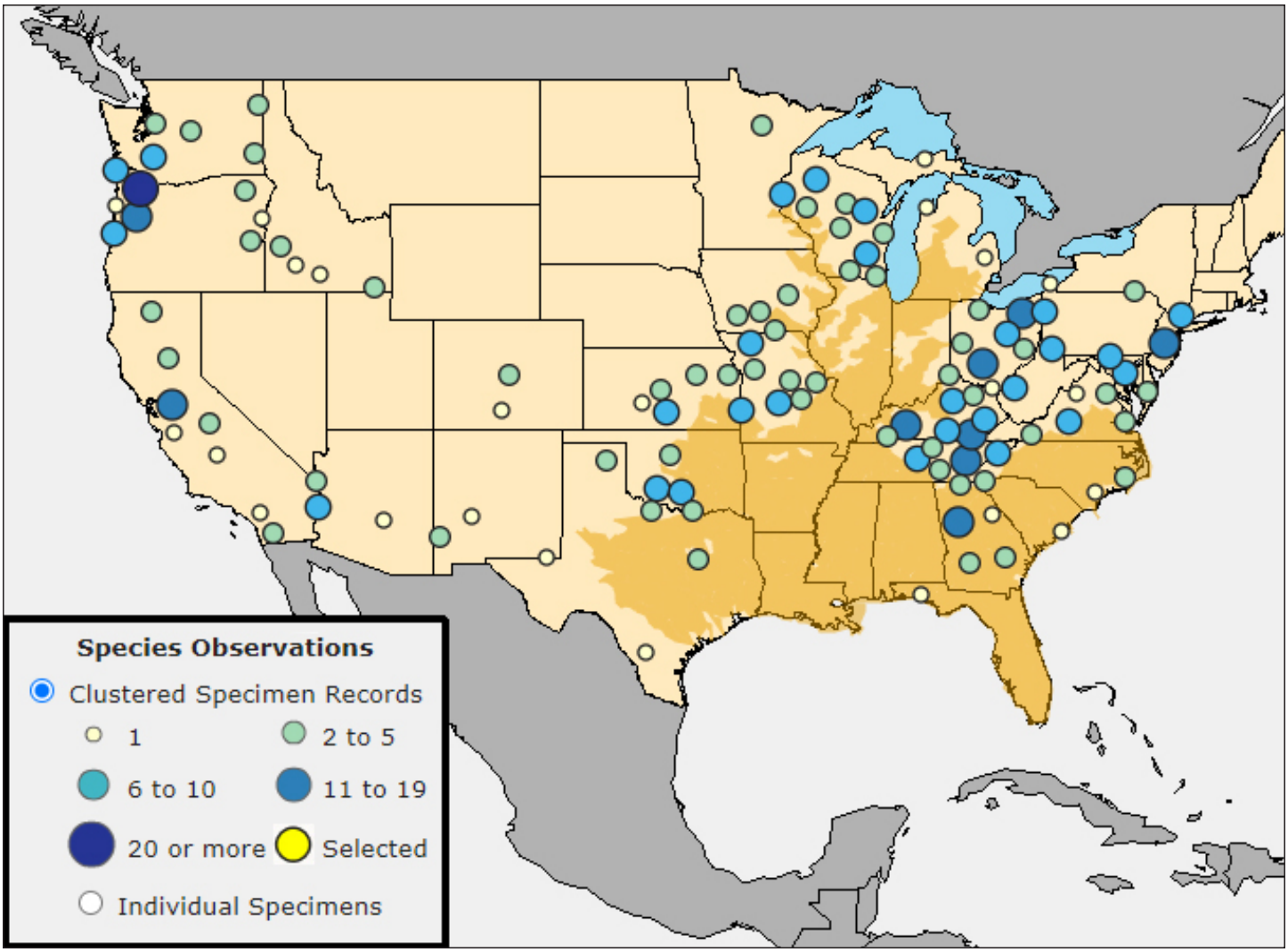

Figure 6. Non-indigenous observations of Warmouth. Brown shading is the native range of the species (US Geological Survey 2022).

eries, Jim Mayhew (personal communication, Nov. 26, 2017). Whether any of these stocked populations persist is unknown. Like Minnesota and Wisconsin, Iowa has a long history of fish rescue operations.

Bob Hrabik is a retired Missouri Department of Conservation (MDC) fish biologist who is now writing the *Fishes of Missouri*. Based on the data used in the book, he produced a map, with a caveat or two, of the current native versus non-native Warmouth distribution in Missouri (Figure 7). Bob believes the Missouri River forms the northern edge of the Warmouth's natural distribution in Missouri. The glaciated till plains that extend into Iowa and Nebraska do not provide the habitat for lowland species such as the Warmouth. Bob's view of the native distribution of Warmouth in northern Missouri is consistent with John Olson's view of the occurrence of indigenous Warmouth in southern Iowa.

The Osage River basin in southern Missouri remains a quandary whether Warmouth were unintentionally stocked or spread from indigenous populations. One very early record indicates Warmouth were native to the Osage River near its confluence with the Missouri River. However, the data suggest following the creation of Lake of the Ozarks in 1931 and Truman Reservoir in 1979, Warmouth have wandered at will. In the Truman Reservoir, Warmouth invaded Baker Branch, where the state-listed Blacknose Shiner *Notropis heterolepis* historically occurred but is now believed to be extirpated.

Again, Bob searched and confirmed fish rescues (aka salvage) were a widely used management practice early in MDC history, but added it was also not uncommon to have species such as sunnies, silversides, and minnows inadvertently transferred from hatcheries to stocking locations. Bill Pflieger (1997) suspected this is how the Blacktail Shiner *Cyprinella venusta* became established in the upper Osage River basin.

Brandon Brown is a fish research biologist with the Oklahoma Department of Wildlife Conservation. He wanted to consult with others to confirm but was aware the southwestern part of the state held "neat little disjunct populations of 'eastern fish' which includes Warmouth". Brandon visited Larry Cofer, who is a retired fisheries supervisor for southwest Oklahoma. Larry believes the occurrences in the Lawton area were natural and simply missed in early sampling efforts. Brandon concurred about the lack of sampling efforts and gear bias for other species. He has found a number of range extensions and feels what was assumed to be natural distributions were too conservative. His hunch is most, if not all, the dots for Oklahoma (Figure 6) are naturally occurring populations.

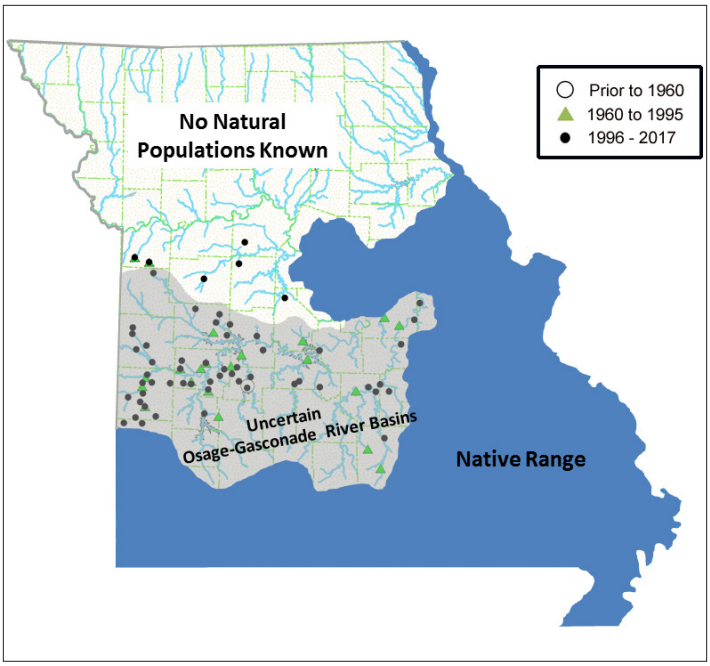

Figure 7. Native range of Warmouth in Missouri. Map by Bob Hrabik (MDC).

Figure 8. Images used for informational flyer: Warmouth (top) and Rock Bass. (Photos by John Lyons)

Nevertheless, he had to add the caveat like John and Bob, "in the old days we did move a lot of stuff around and who knows what could have been mixed in."

2018–2021 WARMOUTH SURVEYS IN RICE RIVER WATERSHED (ITASCA COUNTY, MN)

In 2018, I surveyed East Lake (Figure 10: #18) with the assistance of Jenny Kruckenberg (NANFA Regional Rep). Our sampling gear consisted of dip nets and seines, which have been effective on Warmouth in southeastern Minnesota. We found 17 species including the second occurrence of the state-threatened Pugnose Shiner in the Rainy River drainage, but no Warmouth. In 2019, we surveyed East Lake with gill nets and mini-fyke nets. Again, no Warmouth, but one Northern Sunfish was collected in a mini-fyke net. We also contacted lakeshore owners in-person or via an informational flyer left at vacant cabins providing the history of Warmouth in the lake and comparison photos of Warmouth and similar native Rock Bass *Ambloplites rupestris* that occurs in the lake (Figure 8). Lakeshore own-

Figure 9. 2021 Warmouth from Big Ole Lake. (Photo by Konrad Schmidt)

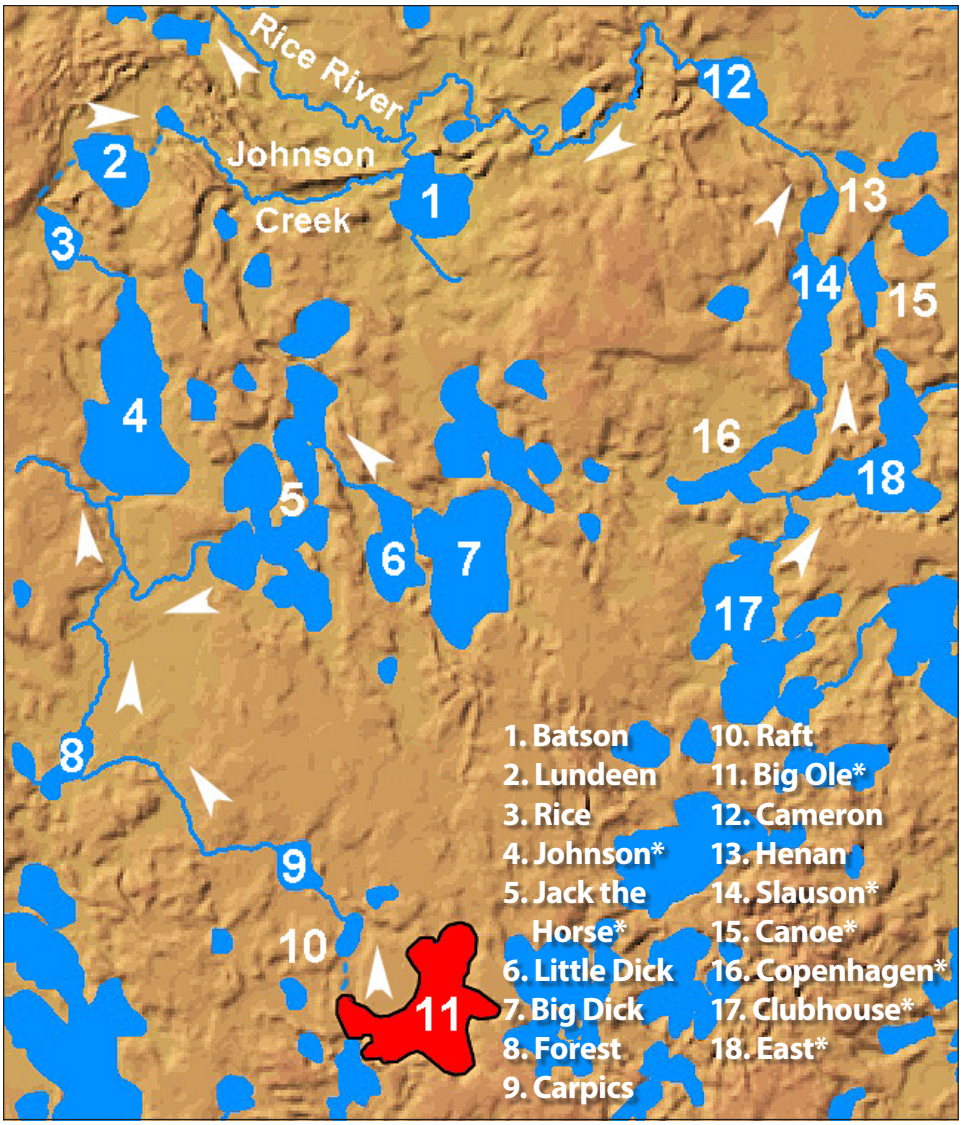

Figure 10. 2018–2022 Warmouth survey study area. Lakes surveyed are marked with asterisks (*). Warmouth were found only in Big Ole Lake (#11). Arrows indicate direction of flow.

ers were rather confident they had not seen Warmouth, and I did not receive any responses from other residents whom their neighbors called, "weekenders."

In 2020, I returned to survey Slauson and Canoe lakes downstream of East Lake (Figure 10: #14 and 15, respectively). Still no Warmouth, but I did find Pugnose Shiner and Northern Sunfish in Slauson. I also surveyed Big Ole Lake (#11) and found Warmouth still very much present (Figure 9). I also inspected the pour point on the far side of the lake (Figure 3). There was a dry, but well-defined channel leaving the lake going to Raft Lake (#10). This channel remains a potential vector during high flows for Warmouth spreading into the Rice River watershed. My last effort for Warmouth was in 2021 when I surveyed Johnson (#4) and Jack the Horse lakes (#5) downstream of Big Ole and Copenhagen (#16) and Clubhouse (#17) lakes near East Lake (Figure 5). The same results: no Warmouth, but Pugnose Shiner were present in Jack the Horse and Northern Sunfish in Copenhagen. The Minnesota Department of Natural Resources also conducted a fish survey of Clubhouse Lake in 2021 and found Northern Sunfish. The scope of my surveys was far from complete. There are many lakes in the Rice River watershed that have no access and never will be surveyed. However, if future funding is available to survey for rare fishes (i.e., Pugnose Shiner and Northern Sunfish), the results may further support Warmouth are restricted to Big Ole Lake.

ACKNOWLEDGEMENTS

I want to thank the NANFA members John Lyons, John Olson, Robert Hrabik, and Brandon Brown for providing information on Warmouth in their respective states. I also must credit Jay Hatch for coming up with the catchy title for the article.

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